



FAA Global Navigation Satellite Systems (GNSS) Programs Update

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FAA GNSS Programs

- **Global Positioning System (GPS)**
- **Space Based Augmentation Systems (SBAS)**
 - **Wide Area Augmentation System (WAAS)**
- **Ground Based Augmentation Systems (GBAS)**
 - **Local Area Augmentation System (LAAS)**

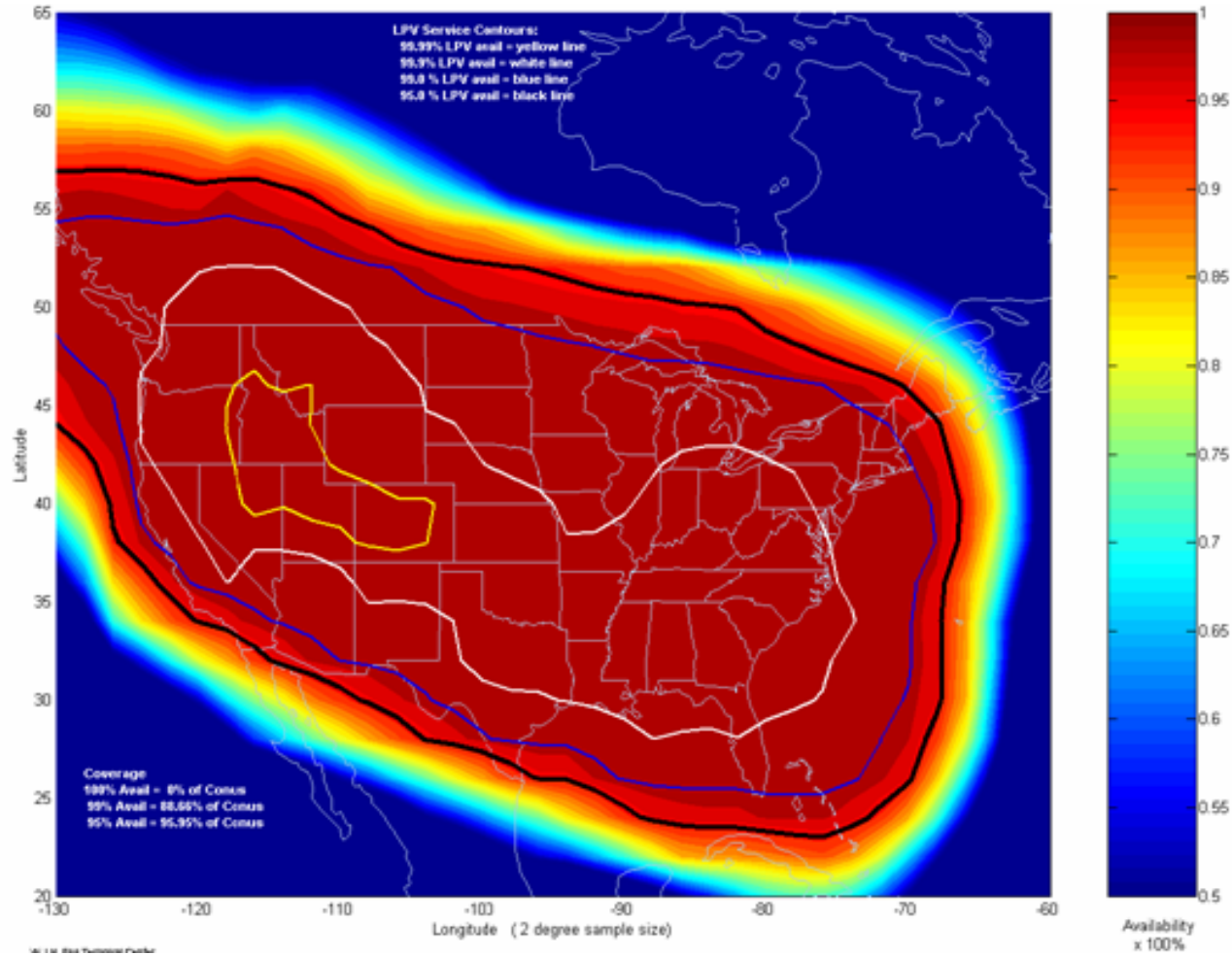
WAAS Status

- WAAS has been available for recreational use and visual flight rules since August 2001
- WAAS was approved for aviation instrument operations on July 10, 2003
- Provides 100% coverage of Continental US & Alaska from 100,000ft. to surface
- Began publication of WAAS specific approaches in September 2003
- Continuing to develop the system to expand vertical navigation to most of North America

WAAS Capabilities

- Initial Operating Capability (IOC)
 - 100% Coverage CONUS & Alaska From 100,000 Ft. To Surface (LNAV)
 - Horizontal Accuracy <1.5M
 - Vertical Accuracy <3M
 - Better Than 99.99% Availability Of System
 - 95% Availability In CONUS Of Approach with Vertical Guidance
 - 350' Minimum
 - WAAS Specific Approaches (LPV) Published
 - Sep 2003 - 250' Minimums

WAAS LPV Availability Since Commissioning



WAAS Schedule

- IOC (Initial Operating Capability) 2003
- Incremental Improvements 2003 - 2008
 - Ground System Development Ends
 - System Improvements Will Be Brought Online Incrementally
 - End State Performance Will Result In Greater Availability Of Approach with Vertical Guidance (LPV - 250 Foot Minimums)
 - 99% CONUS
 - 95% In Most of Alaska
- Two GEOs In View to All Users Over All CONUS and Alaska 2007
- GPS Modernization 2013
 - L5 Frequency (Block IIF & GPS III)
 - WAAS 200' Minimums (First WAAS Precision Approach)
 - Better Interference Mitigation

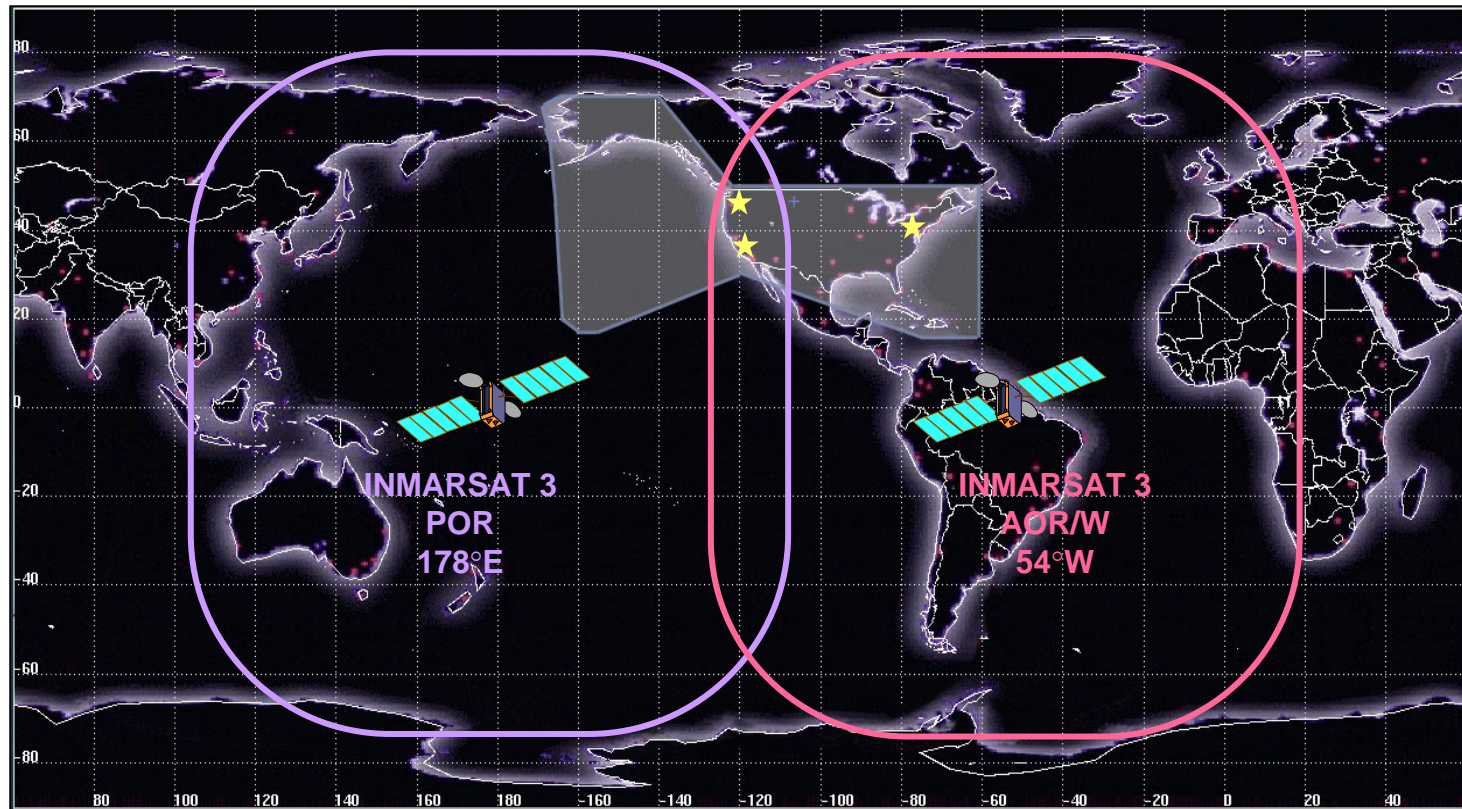
Development Activities

- System Enhancements:
 - 13 Additional WRSs To Improve Availability And Coverage
 - 4 Alaska
 - 5 Mexico
 - 4 Canada
 - Provide Two GEO Satellites In View To All Users
 - Enhancing The Terrestrial Communications
 - More Efficient Monitor Algorithms
 - Enhanced O&M Efficiency
 - Equipment Upgrade Using COTS When Feasible

North American WAAS



Current GEO Service Inmarsat III

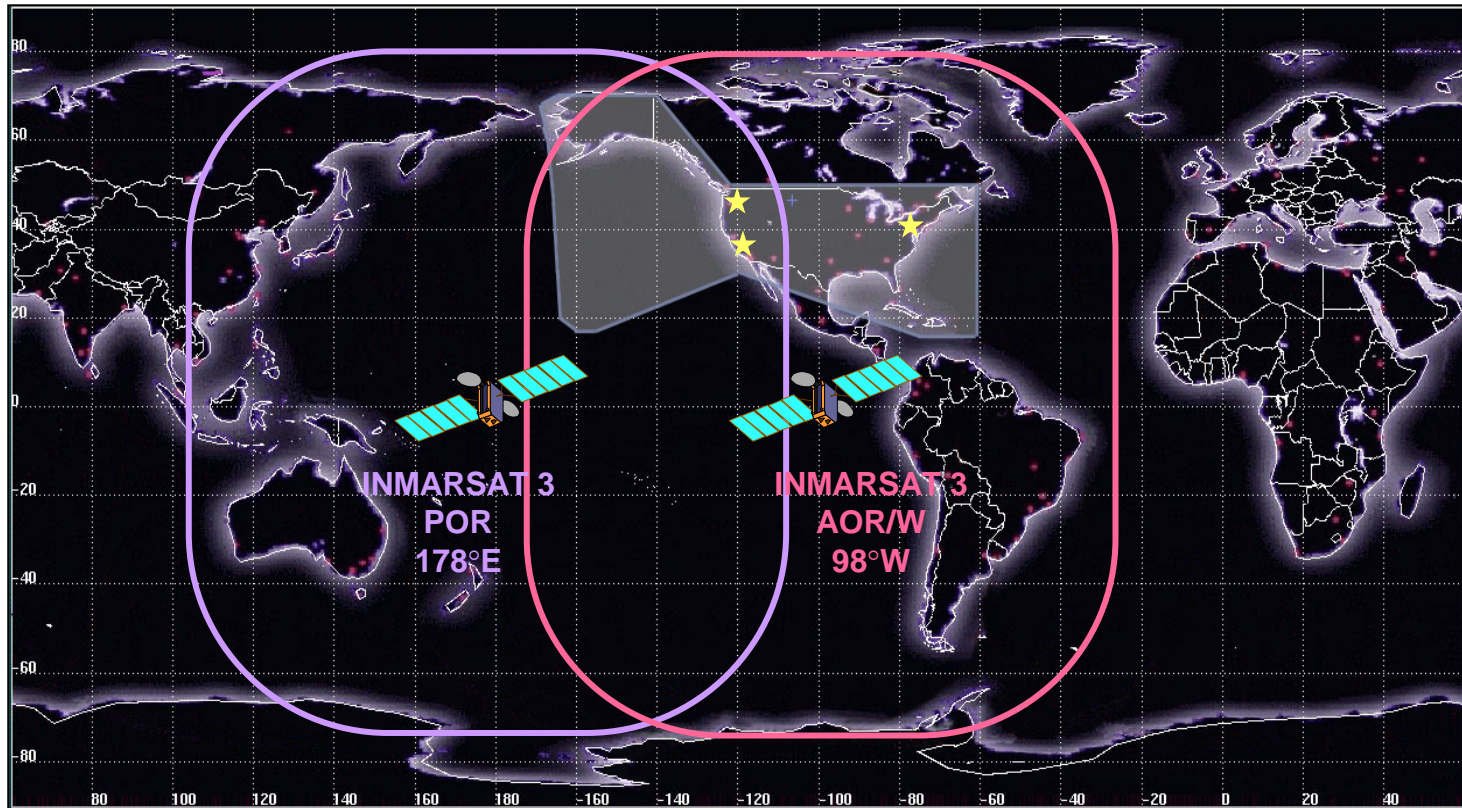


- Main Problem Is Single Coverage Over the Majority of CONUS

Inmarsat III

- Current INMARSAT Lease Expires September 2006
- Market Survey Released In May For Possible Lease Extension To 2009/2010
 - Three Vendors Replied
- INMARSAT Currently Plans To Move One Of The Satellites (AOR-W) In April - June 2005
- MITRE And ZETA Associates Are Investigating Use Of The Navigation Payload While The Satellite Is In Orbit Transfer

Inmarsat III with AOR/W at 98°W

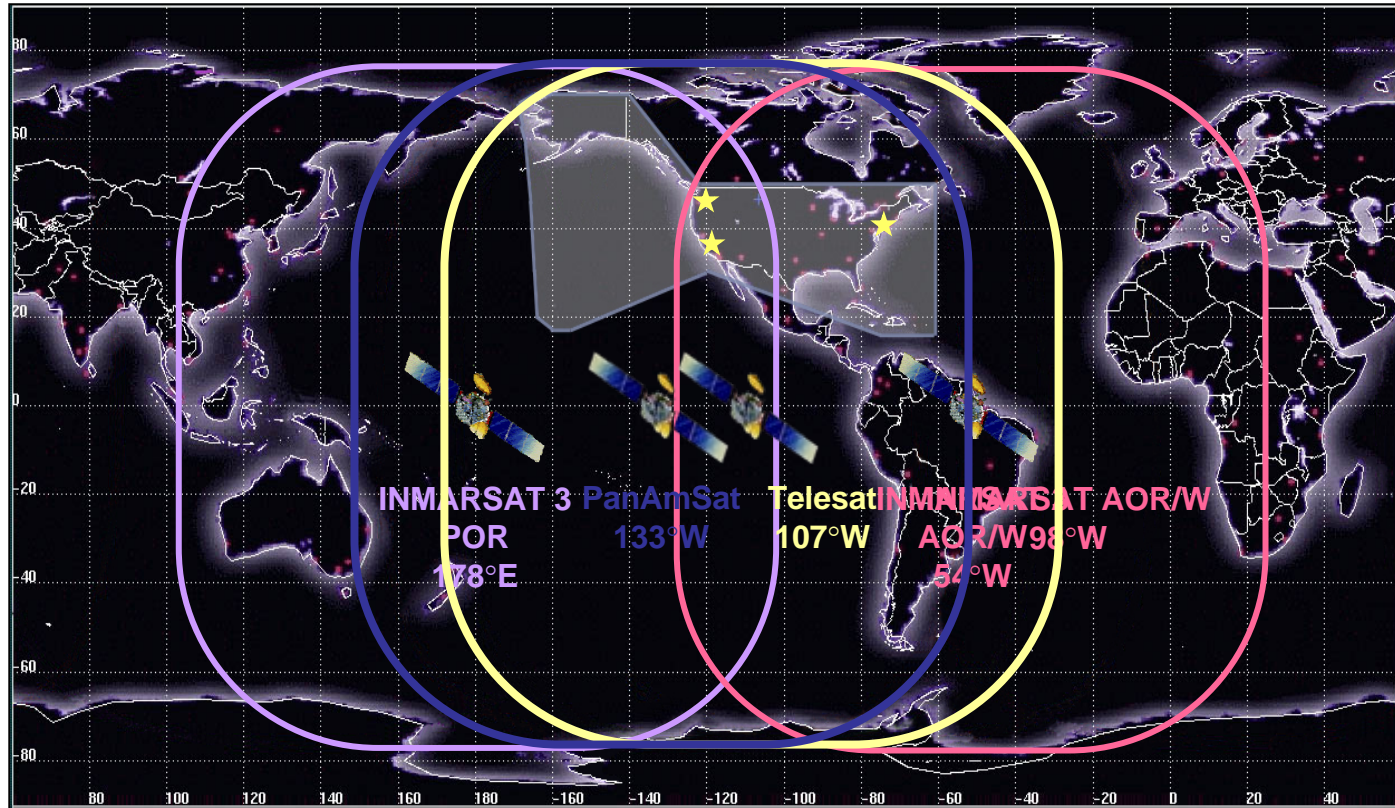


- Still Single Coverage Over the Majority of CONUS

GEO Sustainment

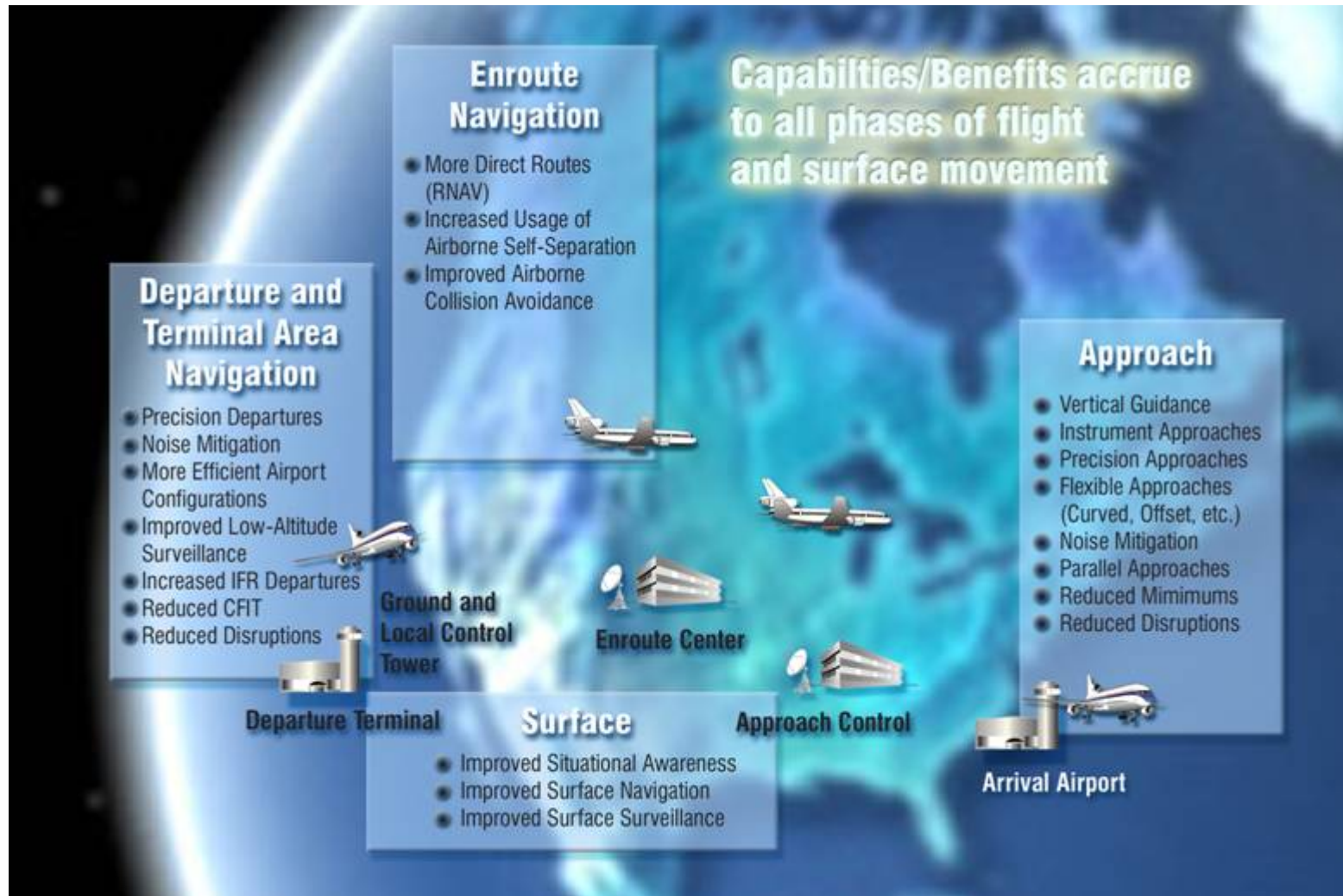
- Lockheed Martin Prime Contractor
- Contract Definitization Expected To Be Complete by September 2004
- Contract Structured to Provide:
 - Leased Payloads on Up to 3 Satellites
 - Subcontract Awarded to Telesat
 - Subcontract Awarded to PanAmSat
 - No plan at this time on Award of Third GEO
 - Ground Infrastructure to Support Signal in Space
 - Four Sites Planned
 - Development of L5 Signal Generator and Receiver
 - Completed Design Review – 2003
- Operational Signal in Space
 - PanAmSat at 133W: 3rd Quarter 2006
 - Telesat at 107W: 2nd Quarter 2007
- Goal is Redundant GEO Coverage with L1 and L5 Over All CONUS and Alaska by 2007

GEO Transition



- Provides Dual Coverage Over CONUS and Alaska with AOR/W as hot spare

WAAS Capabilities For Aviation



User Acceptance Initiatives

- Development of a GAMA receiver for high end general aviation (turboprop and twin engine piston business aircraft)
- Simulation to identify benefits to air carriers and regional airlines of WAAS
- Development of WAAS MMR avionics and integration into FMS
 - Architecture trade offs
 - Capability trade offs
- Teaming with selected users to demonstrate WAAS benefits
 - Procedure Development (Including Surveys)
 - Avionics Installation
 - Operational approvals

Potential WAAS Civil Applications

- Agriculture
- Aviation
- Maritime
- Highway
- Railroad
- Precision Timing
- Mining/Geology
- Surveying
- Banking
- Remote Sensing
- Power
- Telecommunications
- Law Enforcement
- Emergency
- Disaster Response
- Weather
- Construction
- Recreation
- Environmental Mgmt
- Mapping/Geodesy

Current WAAS Civil Applications

- Agricultural
- Marine
- Outdoor Recreation
- Surveying
- Emergency
- Millions of Civil Users Today



Latest GPS/WAAS Receivers



Magellan RoadMate
Automotive



Trimble R8



Garmin StreetPilot 2620
Automotive



John Deere StarFire iTC
Agriculture



Garmin Quest
Automotive/Marine/Adventure



Lowrance LCX-104C Marine
Receiver

Quest



Portability meets capability in the pocket-sized Garmin Quest™. This easy-to-use unit is loaded with the high-end navigation features from our most popular GPS navigators, and best of all, it's portable. So, you can use it in multiple vehicles — or slip it in your pocket for handy street-level directions when you're navigating on foot.

From salespeople to summer vacationers, Quest's features are sure to please:

- Automatic routing with turn-by-turn directions and voice guidance to get you where you're going
- High-speed processor means fast automatic off-route and detour recalculation
- Rechargeable internal lithium-ion battery that provides up to 20 hours of use
- USB data connection for fast map downloads from Garmin's entire line of MapSource CDs
- 256-color, bright, sunlight-readable display makes it easy to view turn-by-turn instructions and map detail

Smaller than a standard television remote, the Quest provides an ample screen viewing area, but it won't demand a lot of room on the dashboard or in the briefcase. The unique antenna folds flush with the unit when not in use and users can connect an optional external antenna as well.

The unit ships with fully unlocked [MapSource® City Select® CDs](#), which provide full coverage of the entire United States, Canada, and Puerto Rico (North America version) or major metropolitan areas throughout Western Europe (Europe version). For weekend warriors who want to use the unit on a camping or fishing trip, the Quest is waterproof and fully compatible with the entire line of MapSource outdoor cartography. With 115 megabytes of internal memory, this small-but-powerful GPS navigator has plenty of built-in map storage. So, in a pocket or on your dash, Quest gives you the freedom to travel light — with lots of map detail at your fingertips.

Expected Availability (U.S. version):
Now Shipping

Expected Availability (European version):
October 2004

Quest Suggested Retail Price:
\$642.84 U.S.D. (for domestic US market only)

Product Showcase

click to view

Package includes:

- Quest with flip-up GPS antenna
- PC/USB cable
- A/C power adapter
- External speaker with 12-volt adapter cable
- Vehicle suction cup mount
- Quick reference guide
- Owners manual
- **One** version below*:

► **Americas:**
[Americas Autoroute basemap](#)
[MapSource® City Select](#)
[North America CD](#) with full coverage and full unlock

► **Europe:**
[Atlantic & Southern Europe](#)

Revised LAAS Strategy

- Goal to Provide Early Operational Approvals For Airlines at a Reduced Cost to the FAA
- Lessons Learned Will Reduce Overall Technical and Programmatic Risk to the FAA For Future Development of LAAS
- Meets Customers' Needs

Issues

- **Honeywell Beta-LAAS Does Not Meet Federal (FAA) Or International (ICAO) Standards**
 - Primary Issue is Integrity
- **An Upgraded SARPs Compliant Beta-LAAS (Prototype LAAS) May Be A Suitable Alternative To Obtain Operational Approval**
 - Use in IMC By Airlines in Revenue Service
- **Is There a Viable Path to Early Operational Approval of the Beta-LAAS ?**

Prototype LAAS

	Federal LAAS	Prototype LAAS	
Integrity Requirements	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<ul style="list-style-type: none"> •No MOPS Change Required •Requires Iono Storm Monitoring
Design Assurance	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<ul style="list-style-type: none"> •Reduced Effort Based on Contractor Artifacts
Interface to ATC	<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> •Procedural or Minimal Impact
FAA O&M	<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> •Contractor Maintenance

ROM Estimate: \$45-50M, 3 years

System Integrity

- **LIP Approved Integrity Risk Resolutions Must Be Implemented**
 - Ionospheric Threat And Monitoring Algorithms
 - Overbounding Analysis, HMI Analysis, Multipath Modeling
 - 14 Element MLA Antennas And Improved GPS Receivers Will Be Needed
 - Some Beta-LAAS Antenna Posts May Need To Be Re-Located to Meet Siting Constraints
- **Technical Consensus on Mitigation for Iono Threat Expected By September 30th**
 - Anticipate No New Requirements For Airborne Monitoring
 - Will Require Ionospheric Storm Monitoring or Other Operational Mitigation

System Design Assurance

- **Design Will Need To Be Qualified To Industry Standards**
 - SAE-4754 & SAE-4762
 - Same Process Used To Design & Approve Aircraft
- **Safety Analysis Documentation Will Need To Be Completed**
 - OHA/FHA, SSA
 - FTA/FMEA, HMI Analysis, Etc.
 - Operational Mitigations For Outstanding Issues Identified In The OHA Will Be Needed
- **All System Software Will Need To Meet Applicable RTCA/DO-178B Objectives**
 - Contractor Format For Artifacts In Lieu Of The FAA-STD-026 Documents Would Be Acceptable
- **All Hardware Will Need To Meet Applicable RTCA/DO-254 Objectives**
 - Contractor Format For Artifacts Would Be Acceptable

Summary

- WAAS Benefits All Classes Of Users
 - Has Been Available VFR For Over 4 Years
 - Commissioned For IFR Use On July 10, 2003
 - Signal Enhances Navigation In All Phases Of Flight
 - Signal Is Usable From Surface To 100,000 Feet
 - Provides Vertical Guidance To All Runway Ends
 - Aviation Receivers Available Today
 - WAAS Is Being Improved Incrementally To Bring Added Capability Online As Soon As It Is Ready
- LAAS Research & Development is Continuing
 - Goal to Provide Early Operational Approvals For Airlines at a Reduced Cost to the FAA
 - “Beta-LAAS” Is Being Investigated To Meet Customer Needs
- FAA GNSS Programs Demonstrates FAA Commitment To Improving Services For All Aviation Users



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AIR TRAFFIC ORGANIZATION

<http://gps.faa.gov>